

RICHARDSON, (M.H.)

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# Operations on Nerves.

CASES OF NERVE SUTURE, NERVE SECTION, NERVE  
STRETCHING, AND OPERATIONS TO RELIEVE  
PRESSURE UPON NERVE TRUNKS.

By MAURICE H. RICHARDSON, M.D.,

*Visiting Surgeon to the Massachusetts General Hospital; Assistant  
Professor of Anatomy, Harvard Medical School; Instructor  
in Surgery, Boston Polyclinic.*

*presented by the author.*

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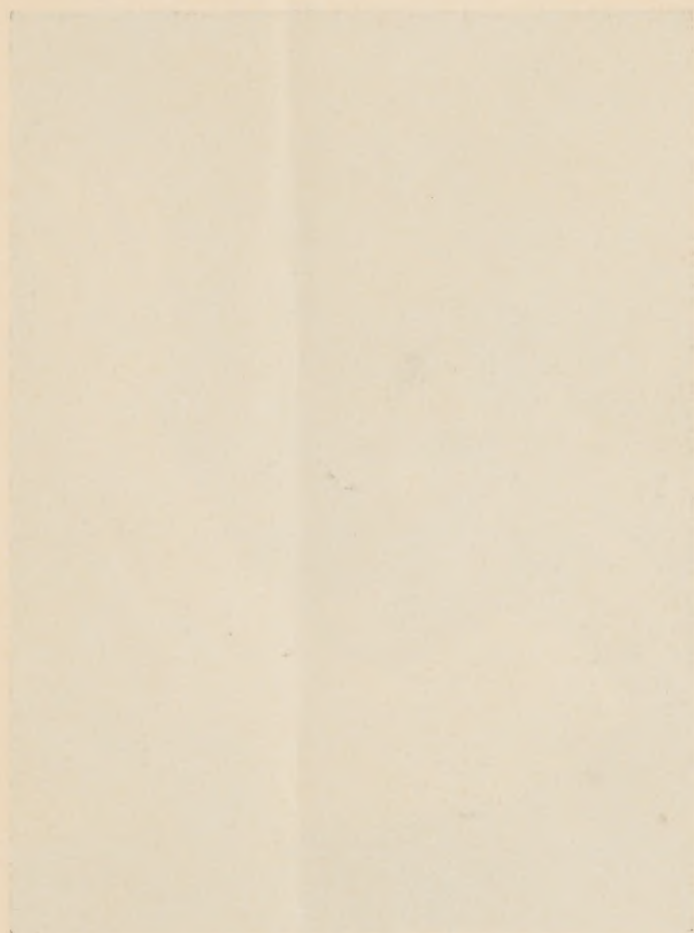
*Reprinted from the Boston Medical and Surgical Journal  
of October 21, 1886, and February 9, 1888.*

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The transverse scar represents the original wound ; the longitudinal one, the incision to find the nerve-ends. From a photograph.







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# OPERATIONS ON NERVES.

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*Surgeon to the Massachusetts General Hospital, Assistant Professor  
of Anatomy, Harvard Medical School.*

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## FIRST PAPER.<sup>1</sup>

- I. RESECTION AND SUTURE. (a) Musculo-Spiral, (b) Median, (c) Ulnar.
- II. PRIMARY SUTURE. (a) Ulnar, two cases.
- III. EXCISION FOR PAIN. (a) Middle cutaneous of thigh, (b) Long-saphenous, (c) Inferior dental, (d) Infra-orbital.
- IV. STRETCHING. (a) Spinal accessory for spasmodic wry-neck.

THE cases recorded below were treated at the Massachusetts General Hospital during the past fifteen months, with the exception of the last, which was at the Carney Hospital.

## SECONDARY NERVE SUTURE.

CASE I. Injury to median nerve from bursting of bottle. Healing. Painful neuralgia in finger and thumb, with loss of power in thumb. Removal of in-

<sup>1</sup> Read before the Boston Society for Medical Improvement, October 11, 1886, and published in the Boston Med. and Surg. Journal, October 21, 1886.

jured portion of nerve, suture, relief of pain, and restoration of motor function.<sup>2</sup>

Patient, J. C., a young man, bar-tender, was injured by the bursting of a ginger-tonic bottle, July 20, 1885, in the left wrist, in front. The cut healed readily, but there was loss of sensation in the middle and fore-fingers and the palmar surface of the thumb. Accompanying the loss of sensation, there was severe pain in the thumb and palm of the hand. This symptom of severe pain led him to come to the Nervous Department of the Hospital, where Dr. Putnam examined him and recommended an attempt to relieve the symptoms by surgical means.

July 18, 1885, operation with ether.

The median nerve was quickly exposed at the point where it was supposed to have received injury, about one and one-half inches above the palm. The nerve was found involved in the cicatrix and almost entirely severed, being united by only a few fibres. The whole nerve was isolated from the surrounding parts, and the injured portion entirely excised by a transverse section above and below. The ends, which were sharply cut and clearly defined, were then brought into apposition and sewed together. Considerable traction was first used, so that there would be as little tension as possible. A catgut suture was then passed into the proximal trunk half an inch above the cut,

<sup>2</sup> Mass. Gen. Hosp. Records, Vol. 220, p. 73.

and brought out in the centre of the divided end. It was next introduced into the centre of the end of the distal part of the nerve and brought out half an inch farther along.

The divided sheath of the nerve was then brought into close approximation by fine catgut sutures, care being taken to include only the sheath itself. The wound was closed with silk, drainage provided for, and the arm and forearm placed upon an internal angular splint with the carpus well flexed. The wound healed rapidly, though not by first intention, and the patient was discharged, August 11th, to the convalescent ward. There had been no change in his symptoms, except almost complete relief of pain. There was still slight pain in the top of the thumb, ulnar side.

August 29, 1886, a little more than a year later, I examined him. There was a prominence in the anterior carpal region at point of suture. Sensation was good in all parts supplied by the median. There was no pain, and had been none for months. Finally, the muscles supplied by the median alone, *adductor* and *opponens pollicis*, were well developed and responded to the man's will. In this case, therefore, the functions of the nerve were completely restored.

CASE II. Stab in back of arm. Division of musculo-spiral nerve. Wrist-drop. Suture of nerve stump; suppuration; erysipelas; no improvement at end of

three months. Second operation. Resection and suture. Complete and permanent recovery after four months.<sup>2</sup>

George Donahue, laborer, forty-three years of age. Came to the Massachusetts General Hospital, May 19, 1885, having been stabbed by an Italian with the blade of a pair of shears. The external wound was small. The triceps was cut and the musculo-spiral nerve severed. Two small pieces of bone were clipped from the humerus. Had wrist-drop and inability to extend fingers.

Dr. Warren enlarged the cut. The ends of the nerve were found and united with six small catgut sutures through the sheath. The triceps was sewed up with catgut. Drainage-tubes were left in wound and sterilized cotton dressings applied. Arm put on internal angular splint.

After the operation, some sensation along course of radial nerve was noticed. One month after had erysipelas and prolonged and extensive suppuration of whole upper arm. July 6th, Dr. Putnam found no reaction to galvanic current. Sensation was found over dorsum of hand. Strong wire brush current caused painful sensations everywhere supplied by musculo-spiral. Muscles were soggy and skin dry and hard. Voluntary motion of ulnar and median preserved, but feeble.

<sup>2</sup> Mass. Gen. Hosp. Records, Vol. 220, p. 108.

Reëntered hospital August 10th, for resection of the nerve, not being able to use arm, his condition being same as when discharged. At this time the case was examined by Dr. Putnam with me, and it seemed best not to wait any longer before making another attempt, on the ground that there had not been the slightest improvement or sign of any, and that the failure of immediate union, with prolonged and extensive suppuration of the neighboring parts, rendered it extremely improbable that any improvement in his condition would ever result.

It having been decided to make a second attempt, the patient was etherized and the musculo-spiral nerve exposed by a cut about six inches in length made over the normal course of the nerve at an angle with the scar of the stab. It was found running into the dense mass of cicatricial tissue by which the former wound was healed, and from which the distal portion of the nerve was with some difficulty found emerging. The nerve was divided above and below the old wound by a clean, sharp incision, and the cicatricial tissue with the excised nerve-end was dissected out. This specimen measured an inch and a half. (See Fig. I.)

After thorough stretching of the proximal end, by which the nerve was quite materially elongated, the sheath was united with seven fine silk sutures threaded upon a fine cambric needle. The joint made in this manner was quite perfect. (See Fig. II.) No suture

was put into the nerve itself. The external wound was closed with silk, drainage established, and the whole arm extended upon a straight splint. The most careful antiseptic precautions were taken and the wound healed immediately by first intention under Dr. Warren's sterilized cotton dressings.

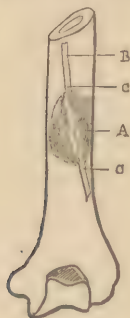


FIGURE I.

A, Cicatricial tissue.  
B, Musculo-spiral nerve.  
C, Points where nerve was divided  
for suture.

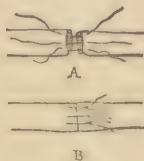


FIGURE II.

A, Cut ends of nerve, showing  
sutures applied ready for tying.  
B, Same, knots tied.

No improvement of any importance was observed up to the time of his discharge except that he could use his *extensor secundi internodii pollicis*. He was discharged to report to Dr. Putnam, whose patience in his treatment was rewarded about four months later by a complete restoration of the powers of the nerve.

Ten months after the operation, I saw the patient holding a piece of iron pipe weighing more than a hun-



dred pounds, which he was putting into a deep hole he had just dug in the streets. (See Frontispiece.)

CASE III. Ulnar nerve completely divided by glass. Healing of wound. Motor and sensory paralysis. Resection and suture of nerve stumps. Union by first intention. Case still under observation.<sup>8</sup>

Mary Quinn, twenty-two years, single, domestic. August 10, 1886, patient came to hospital having previously cut wrist in putting her hand through a pane of glass. The wound had entirely healed. There was loss of sensation in little and half of ring fingers, while abduction and adduction of fingers was very slight.

Patient was etherized and a cut made over the ulnar nerve on the radial border of the *flexor carpi ulnaris*. This cut was at right angles to the original wound. The ends of the divided nerve were only found after a long dissection as their relations were considerably altered and the distal portion of the nerve retracted some distance. The upper portion of the nerve was stretched as much as possible before refreshing the end, but it was found extremely difficult to elongate the trunk sufficiently to make it join the peripheral portion without considerable tension.

The stumps were united by eight fine silk sutures,

<sup>8</sup> Mass. Gen. Hosp. Records, Vol. 224, p. 135.



passed upon cambric needles through the nerve sheath. (See Fig. II.) The arm was placed upon a splint and carpus kept in flexed position. Two weeks later she was sent to the Convalescent Home, the incision having healed perfectly by first intention, with no constitutional disturbances, under antiseptic dressings. She was sent to the neurologist upon her discharge from the home, and is now under observation, with as yet no apparent restoration of motor-power in the nerve, and without any disturbance from neuritis or other cause. (See Case II, in Second Paper.)

#### PRIMARY SUTURE.

CASE IV. Laceration of arm just above internal condyle. Ulnar and internal cutaneous nerves torn. Suture of ulnar. Union by first intention. Case under observation, symptoms as yet negative.<sup>4</sup>

Bartholomew Lynch, entered hospital July 8th, with left arm lacerated half an hour before admission by being caught in a flying belt. There was a ragged wound of left arm two inches above internal condyle. The wound extended from near the middle line in front around to the back of the arm, dividing the ulnar nerve, basilic vein and part of the *triceps* muscle and tendon. The wound was filled with dirt and blackened grease. After prolonged searching the

<sup>4</sup>Mass. Gen. Hosp. Records, Vol. 226, p. 53.

stumps of the torn nerve were found. The ragged ends were carefully cut off above and below, three-fourths of an inch of nerve being thus sacrificed. Both portions of nerve were stretched with as much force as it was possible to apply, and the sheaths were united with fine silk sutures.

The *triceps* muscle and tendons were united with cat-gut sutures and the external wound closed with silk. The forearm was extended upon a straight splint, the wound having been covered with iodoform and carbolic gauze. Discharged on the 19th to report to the neurologist. No improvement noticed when last seen, and no pain or discomfort from the operation.

CASE V. Cut of wrist. Ulnar nerve, *flexor carpi ulnaris*, and ulnar artery divided. Ligature of artery. Suture of tendon and nerve. Immediate union, absence of local and constitutional symptoms.<sup>5</sup>

The patient came to the hospital August 10, 1886, with a fresh cut of the wrist, ulnar side, a short distance above the joint, caused by a piece of glass. The ends of the nerve were found and united by their sheaths, fine silk sutures being used. He was sent back to the out-patient room and made a rapid recovery, the wound healing by first intention. There was absence of all constitutional and local symptoms. He was then referred to Dr. Walton who reports to-

<sup>5</sup> Mass. Gen. Hosp., Out-patient Department.

day, eight weeks after operation, as follows: There has been no improvement as yet, although the area of anæsthesia has retracted a little. I have never been able to find this man since.

#### NEURECTOMY.

CASE VI. Cut over middle of right thigh. Pain in scar and along course of middle cutaneous branch of anterior crural nerve. Painful cramps in calf. Dissection. Branch of nerve found to enter scar. Excision of scar eight months later, and an inch of nerve trunk. Cure.

James Prento, thirty-three years. In August, 1885, cut his right thigh with an ice hook. There was, on entrance to the Hospital, April 3, 1886, a small scar on the right thigh, six inches above the knee-joint, at its middle and outer part. There was pain at this point, and he was tormented by frequent and persistent cramps of the muscles of the calf. He was seen by Dr. Walton, who considered the pain and cramps probably due to the scar in which it was thought some branch of the middle or external cutaneous nerve was entangled. An operation was therefore advised for the removal of the scar and a portion of the nerve, if any should be found.

A cut was made above the scar parallel to the usual course of the nerve. A small branch of the middle

cutaneous nerve was found an inch or more above the scar, and followed down into it. The scar itself was then dissected out, and with it an inch of the central end of the nerve.

April 26th, patient discharged, wound being healed and the pain and cramps having entirely disappeared.

Dr. Walton, to whom the case was referred after discharge from the hospital, reports as follows: The pain which existed to a greater or less extent before the operation, went away. The cramps ceased. A patch of anæsthesia was found below the scar in the parts supplied by the excised branch.

CASE VII. Cut on inner aspect of foot, of four years standing. Pain in scar referred along course of internal saphenous nerve; dissection. Branch of nerve found involved in scar. Removal of scar and portion of nerve; cure.<sup>6</sup>

John Sullivan, aged forty-eight, had a painful scar on the inner aspect of the left foot, from a cut four months before. Suffered a good deal of pain in the region of the scar, of a lancinating character. Referred to me by Dr. Walton. I found, on cutting down upon the probable course of a branch of the long saphenous nerve, a small filament, which, when followed, was found to enter the cicatrix. An inch of the nerve was excised, and the scar itself. A complete cessation of the pain followed immediately.

<sup>6</sup> Out-patient Department, September 4, 1886.

CASE VIII. Neuralgia of inferior dental nerve for five years. Division of nerve inside mouth; relief for two years. Return of pain in aggravated form, lasting one year. One inch of nerve destroyed by opening inferior dental canal from outside. Immediate recovery and cure.<sup>7</sup>

S. P. B., seventy-two years old, entered September 3, 1886. Eight years ago, developed severe neuralgia in the right side of the face, over the lower jaw. Three years ago, inferior dental nerve was divided just above the point where it enters the dental foramen. This operation gave relief for two years, when the same trouble returned.

August 4th. One inch of the inferior dental nerve was cut out. An incision parallel to and through the fibres of the *masseter* muscle, three inches in length, was made down to the jaw-bone. With a gouge and mallet, a narrow opening, one inch long, was made through the ramus of the jaw over the dental canal. The nerve and artery thus exposed were cut at each extremity of the opening, and the whole curetted out. There was little hemorrhage. The external wound was closed with silk, and iodoform dressings applied.

Two days later, stitches and drainage-tube were removed. For some days after the operation there was complaint of slight pain in the parts supplied by the

<sup>7</sup> Mass. Gen. Hosp. Records, Vol. 226. p. 163.

mental branch of this nerve. This rapidly disappeared. He was discharged on the 10th.

August 25th. Came and reported that "it was a real pleasure to live; that he had had more real pleasure in life since leaving hospital than in any ten years before." (See following paper for third operation.)

CASE IX. "Epileptiform neuralgia" of side of nose and face. Neurectomy of infra-orbital nerve; complete cure.<sup>8</sup>

Tim O'Brien, sixty, married, laborer; entered hospital, August 8, 1885, with history of trouble in face for sixteen years. Some years ago had an operation done in an English hospital without relief. Has pain in right side of face and nose, in parts supplied by the infra-orbital nerve. This is spasmodic, and extends from the inner canthus of the eye down to the ala of the nose. During this paroxysm he leans his head upon his hands, with evidence of great pain, and the muscles of the nose contract spasmodically upon the right side, drawing up the ala and wrinkling the skin.

August 12th. Under ether, the infra-orbital nerve was found, a needle having been first inserted into the infra-orbital canal. The nerve was pulled out of the canal as far as possible, and cut. The peripheral end was then drawn up, and its branches dissected down an inch or more, and then divided.

<sup>8</sup> Mass. Gen. Hosp. Records, Vol. 220, p. 100.

The next day patient reported himself very comfortable, with pain much relieved. What pain still existed was referred to the ala of the nose.

August 18th. Five days after operation the pain had entirely left the face.

August 21st. No return of pain; face healed. Discharged.

May 1, 1888. This patient returned to the Hospital a few days ago with the same symptoms as before. He had been successfully treated by Dr. Putnam with rhigolene during the first recurrence of the pain. He is now about to undergo a still more thorough dissection of the nerve.

#### NERVE-STRETCHING FOR SPASMODIC WRY NECK.

CASE X. Spasmodic wry neck, probably of central origin; rapid and uncontrollable contraction of right sterno-mastoid. Constitutional treatment a failure. Head made immovable in plaster-of-Paris helmet; failure. Spinal accessory nerve exposed and stretched. Right sterno-mastoid becomes perfectly quiet, but left becomes affected; patient much improved. Spasm returned two months later to less degree.<sup>9</sup>

James Dutton, twenty-eight years old, weaver; April 10, 1886, entered Carney Hospital. Previous history good. Eight months before entrance noticed a slight twitching of the neck, which would appear at

<sup>9</sup> Carney Hospital Records.



intervals of a week or two. Stimulants or lying down would stop the twitching. Never any trouble in swallowing; no venereal disease. The left side of the neck seemed enlarged and swollen. There was a distinct swelling behind the posterior pharyngeal wall, which looked red, and felt brawny. Two days after entrance the lump in pharynx was aspirated; no pus.

April 26th. Head put into stiff bandage, which kept him steady and comfortable.

June 19th. Head-gear was removed, and head found to shake as much as ever. Became despondent and suicidal.

From July 1st to August 3d, was put upon large doses of quinine, salicylate of soda, and iodide of potash without benefit.

After consultation with Dr. Bullard and the staff, and at the patient's earnest request, it was decided to try stretching of the right spinal accessory, as the twitching seemed to be mostly in the right sterno-mastoid. Operation under ether.

An incision, four inches in length, was made from the mastoid process downward and forward, along the anterior border of the sterno-mastoid muscle. The dissection was carried directly backwards toward the vertebrae, until the nerve was exposed. Continued and repeated tension was put upon it by means of hooks and the fingers. By measurement, ten pounds weight was applied. Dr. W. N. Bullard tested the

nerve with the electric current after each stretching, but at no time did the sterno-mastoid and trapezius fail to respond. The wound was closed antiseptically, and the union was immediate.

The next day the twitching had entirely disappeared, and the muscle remained perfectly quiet for two months. The left sterno-mastoid, which had been perfectly quiet before, now took upon itself an action precisely similar to that which had existed in the right, but less in degree.

Examination, October 11th, shows that there is still rapid contraction of the right sterno-mastoid, though much less than before the operation. His general condition is much improved, and his discomfort is quite trifling.

The first suggestion that the ends of a divided nerve be sewn together in order that the interrupted functions of the nerve might become re-established, dates back many years. "The union of the ends of a divided nerve had already been proposed by Wilhelm von Saliceto and Guy Chauliac in the last century. Arneman mentions this subject, and as it appears, was the first to study the operation experimentally. Unfortunately, according to this author's statements, his first attempts were failures, and it is highly probable that owing to this lack of success the nerve suture found for a long time after Arneman no surgical sup-

port. Up to the twentieth year of our own century but few authors had occupied themselves with this operation, and their researches were, moreover, so incomplete that they could do but little towards the further solution of the question. (Delpeich, Collisan, Lemmering and others.)

“Flourens, however, published in 1828 the results of his experiments, among which several made upon fowls were so successful that they enabled him to determine that a primary union took place between the ends of a divided nerve, and that the same occurred immediately following the application of the suture.

“Larrey at the same time found the central ends of two nerves in an amputation stump completely grown together. Surgically the operation remained for a still longer time without any application, and but a very small number of cases are to be found in the literature of the subject,<sup>10</sup> and they are obscurely reported and scantily described, the operators satisfying themselves with their mere mention.”

The present stage of the operation began in 1864. with the work of Weir, Mitchell, Velatin and Langier. This work has been carried on to the present time by numerous writers until the literature of the subject is very extensive. While most writers agree that the suture of divided nerves should be done, others reject entirely the operation.

<sup>10</sup> Rawa in Kiew. Wien. Med. Wochenschrift, Vol. 35, p. 221, March, 1885.

The indication for nerve suture is generally considered to be when the wound is such that the divided ends do not fall naturally together. When the adjacent parts keep the distal and peripheral stumps in their normal position, and the ends are only separated by the natural retraction of the nerve itself, it is thought that the restoration follows as well as when suture is employed, and that there is less danger of neuritis and other complications.

I believe that suture should be employed in all cases where important nerves are divided, because in no recorded cases have serious local or constitutional symptoms been observed, and because it is only in this that we can hope for a primary intention. In all the cases recorded above, except Case IV, the cut has been a clean incision. Yet, in dissecting down to find the retracted ends or the cicatrix, it has been found either that the nerve ends were so placed as not to fall together or even near together, or when cicatrized that the normal nerve tissue was interrupted by a very considerable interval of dense cicatricial tissue, through which the regenerations must take place, if at all. Nevertheless, it is true that a nerve may regain its functions even when the stumps are separated a long distance and no sutures have been applied.

In *primary suture* it is often difficult to find the ends of the nerve. In Cases IV and V this trouble

was met with. The dissection then should be made well above and below, where the nerve preserves its normal relations. This very fact (difficulty of finding nerves) confirms my belief that the nerve ends do not readily fall together.

The ends having been found, if clean-cut they should be stretched sufficiently to make any longitudinal tension impossible,—so that when sutured the nerve will lie in the bottom of the wound, lax and torturous. This is aided by flexion or extension of the nearest joint, as may be required.

In lacerated wounds where the ends of the nerve are torn and bruised, a clean-cut surface should be made with a sharp bistoury. The use of scissors for this purpose I do not think best because the nerve fibres are crushed between the blades instead of being cut. If it is necessary to remove a very long piece of contused nerve—an inch or more—it is better to leave the contused end rather than trust to great elongation, or to the efforts of nature to fill the gap. In Case IV so large a piece of nerve was excised for this reason that it was found extremely difficult to bring the ends into apposition, and if an unfavorable result follows it may be due to this fact.

In applying the suture the thread is either passed through the nerve itself or its sheath. Of the forty-eight cases collected by Rawa, twenty-one were of the direct variety, through the nerve itself, nine

perineuritic, and the others not recorded. In eight cases of the direct, rapidly disappearing neuroses came on, and once or twice neuritis. The indirect (perineuritic) was followed in but two cases by nerve symptoms.

In Case I, both the direct and indirect method was used. In all the others the perineuritic.

This method I believe to be the better, though most surgeons incline to the direct, believing that a better and more thorough union of the stump surfaces is thus obtained.

It is for this very reason that I believe the indirect method the better. Nothing could be more perfect than the union of the stumps in my cases in the manner to be described. Though the number of sutures employed varies much with different men, the only accurate joining of the ends can be made by six or eight threads.

The material should be silk or catgut. Silk makes the better knot and neater joint, and holds longer. The technique is as follows :

The nerve having been elongated as much as possible without injury to the stump, the ends are let fall into the bottom of the wound in the position they will naturally assume. This will give the anterior surfaces. A fine cambric needle is passed through the sheath, about one-eighth of an inch from its cut edge, towards the end of the stump. It then is passed be-



neath the sheath of the other stump through its open end, and emerges one-eighth of an inch from its edge. The knot is tied and the long ends of the thread left. The assistant takes these long ends and pulls gently away from the operator. This rotates both stumps enough for the placing of the second stitch. This, in turn, is pulled and the next applied. In this way the nerve can be turned enough to place the stitches into the posterior surface. The operation is completed by starting in the centre in front again and rotating the nerve in the other direction. The line of suture made in this way is as perfect as can be imagined. Its strength exceeds that of the direct method, and it may be relied upon to hold the nerve ends together until union is completed.

The prognosis is favorable in nerve suture when union by first intention takes place, though months or years may elapse before the function of the nerve is restored.

The cases of neurectomy and nerve-stretching are offered as contributions to the statistics of these operations. The method used of excising the inferior dental from outside the face proved more difficult than was expected, owing to the depth of the wound, but was very satisfactory, and will doubtless be followed by a long period of rest from pain.

In finding the spinal accessory, the best incision is along the anterior border of the sterno-mastoid. This



should be carried down two or three inches from the mastoid process, and the tissue divided carefully until the nerve is found, running obliquely outwards. Ten pounds weight was applied, and this seems to me about as much as a spinal accessory nerve of average size will safely bear.

NOTE. — Dissections of thirty spinal accessory nerves, made in the winter of 1887-88, showed that the nerve can be found entering the sterno-mastoid obliquely outwards, one and a half inches from the mastoid process. It can be found easily through an incision one inch long at this point.

## SECOND PAPER.<sup>1</sup>

In October, 1886, I presented a paper upon this subject to this Society,<sup>2</sup> with report of several cases. I have been able to follow up several of these cases, and it may be of interest to give the present condition of those I have been able to see recently.

CASE I. George Donahue. Case of suture of the musculo-spiral. This man met with a severe injury to the right upper extremity from the caving in of a sand-bank. He sustained a fracture of the right clavicle, with a good deal of displacement. He has been a good deal disabled in the arm from pain and stiffness in the acromial region. Up to the time of the accident, the usefulness of the upper forearm and hand had constantly improved, and he considered himself as good as ever.

CASE II. Mary Quinn. This case of secondary suture of the ulnar nerve was seen by me often during 1887. The hand was useful, and the muscles supplied by the ulnar were under control to a certain extent, as

<sup>1</sup> Read before the Boston Society for Medical Improvement, January 9, 1888, and published in the Boston Med. and Surg. Journal February 9, 1888.

<sup>2</sup> The preceding article.

shown by the voluntary action of the interossei. The interesting point in this case was the long-continued pain in the cicatrix, extending into the finger. This suture had been made with fine silk. One, at least, of these sutures had been discharged from the wound, and during this process there was considerable local inflammation. This experience led me to use fine cat-gut, instead of silk, in all subsequent sutures, as in the musculo-spiral case.

CASE III. Infra-orbital neuralgia of epileptiform character. One year later there was a slight return. Dr. Putnam relieved this by the use of rigolene, and no second operation was done.

CASE IV. Bixby. Case of inferior dental neuralgia. This returned at the end of a year, and was very violent and paroxysmal in character.

CASE V. Stretching of the spinal accessory for spasmodic wry-neck. No operation has been done subsequently.

I have been informed by Dr. W. N. Bullard, who had the charge of this man after my term of service had expired, that he was considerably benefited by the operation, and that the twitching was very materially lessened. There was not, however, a complete cessation of the spasmodic movements of the head. He was able to be of considerable service about the hospital, and became night nurse in the male ward.

The following cases have come under my observation since my last report. The operation of nerve-suture has been substantially the same as in previous cases, with the substitution of catgut for silk. It is unfortunate that the final result in these cases is so uncertain. They were all under observation long enough for me to determine whether any of the accidents sometimes seen in this operation were present or not, and to see slight return of both motor and sensory function. It is possible that a complete restoration has followed, but I have not been able to see or hear from the cases since.

#### CASES OF NERVE-STRETCHING.

Case I. November 11, 1886. P. J. O., aged forty-eight.<sup>8</sup> Four years ago this woman had severe neuralgic pains in the right side. These lasted for about one year, and then got better. Two years ago the trouble came back on the other side. The marked peculiarity in this case was the severe and uncontrollable contractions of the abdominal muscles on the left side. Every few moments the muscles on that side would contract violently and painfully, producing pleurosthotonos. These attacks were much more pronounced when attention was called to them. Electricity and plaster jackets had been tried without success. Patient couldn't walk. She was very much

<sup>8</sup> Vol. CCXXIV, p. 212, Mass. Gen. Hosp. Records.

bent towards the affected side, and had an almost constant twitching of the affected muscle with severe pain. After consultation with Dr. Putnam it was thought best to stretch the lower intercostal nerves.

November 23d. An incision five or six inches in length was made parallel to and an inch below the lower border of the ribs on the left side. All the nerves in this incision were divided or stretched. Bichloride irrigation, silk sutures and antiseptic dressings. The wound was healed two weeks after the operation. There was no marked change for the better, although the frequency of the attacks seemed diminished.

December 26th, a plaster jacket was applied. She has not been seen or heard from since. This operation was not a success. From whatever cause this spasmodic contraction of the muscles proceeded, it is clear to my mind that stretching of the motor nerves is not sure enough of producing any lasting benefit to warrant so severe an operation. It is necessary to make a very long and deep incision to find the nerves, and if any number of them are to be found the cut will have to be a very long one. To accomplish any decided results I am sure that these nerves must be divided, and a sufficient number to produce a very decided paralyzing effect. There is no danger of a permanent paralysis because the nerve supply to the abdominal muscles is so extensive. It is questionable

whether in a similar case I should advise nerve-section. It was very probable that the trouble in this case was of central origin, and not in the nerve trunks themselves. In such a condition of things I do not see that anything short of complete and permanent paralysis can be effectual. By the incision along the lower border of the ribs a larger number of intercostal nerves can be reached than by any other one cut of the same length.

To paralyse the whole of the muscles it is necessary of course to reach the ileo-inguinal and ileo-hypogastric nerves as well as the intercostals. To divide them all makes the operation very extensive, and, in my opinion, it is to be recommended only in extreme cases, like the above. In such a case I should now cut the intercostals first, and later the ileo-inguinal and hypogastric branches.'

CASE II. Peter Tierney,<sup>4</sup> aged thirty-six, coal heaver. Entered the Massachusetts General Hospital August 26, 1887. General health good. No history of rheumatism or syphilis. Eight months before admission, after unusual exposure to cold and wet in loading vessels at the wharves, patient began to suffer pain in back of thigh. Pain increased, and in a week he was obliged to give up work. Since that time he has suffered constantly with pain in the course of the sciatic nerve. Had been under treatment by Dr. Putnam in

<sup>4</sup> Vol. CCXXXII, p. 192, Mass. Gen. Hosp. Records.

the nervous room of Out-patient Department with massage, cauterly, etc., without much benefit. Complains of severe and constant pain in the back of the left thigh along the course of the sciatic and in back of knee and calf. Pain especially intense opposite the great trochanter and at middle of thigh. Great tenderness to pressure along whole course of nerve. Muscles of left thigh and calf flabby, and an inch less in circumference than in right. Has frequent tingling sensations in left foot.

August 27th. Considerable pain. Lies in bed with leg flexed and everted. Seen by Dr. Putnam who advised deep injections of chloroform. In the afternoon needle of hypodermic syringe inserted deeply between trochanter and ischial tuberosity and seven minims of chloroform injected.

August 28th. Pain in leg unrelieved. Anxious for anything to give relief, and willingly consents to have nerve stretched.

August 30th. Operation under ether. An incision two and a half inches in length was made in the long axis of the thigh commencing at the lower edge of the gluteus maximus muscle half-way between the tuberosity of the ischium and the great trochanter. The fascia was divided and the nerve readily exposed and hooked out of the wound by the finger. It was then forcibly drawn upon two or three times to the extent of raising the limb. A soluble drainage-tube was in-



serted, and the wound closed with a continuous catgut suture. There was nothing abnormal in the appearance of the nerve. The next day there was relief from the pain in the leg, although there was some pain in the cut. No anæsthesia or motor paralysis. Two days after operation complained of pain in the same locality as before operation, but not so intense.

September 6th. A week after operation the wound was dressed for the first time. The tube and the stitches had disappeared. First intention. Pain the same as before.

October 1st. The pain being still severe and unrelieved he was etherized, and extension on the nerve made by strong flexion of the thigh on the abdomen with the leg and foot extended. Recovered from ether well, but there was no less pain in the leg.

Discharged from the hospital on the 5th, to return in three weeks. Has not been seen since.

This case was not benefited in the least by either operation, and it must be considered a complete failure.

CASE III. August 21, 1887. James Brady,<sup>5</sup> laborer, aged fifty. Fifteen years ago patient received a blow over left buttock with a pick. Three months after began to suffer pain in the back of thigh and front of the leg. This pain has continued but with little severity and frequent intermissions ever since.

<sup>5</sup> Vol. CCXXXII, p. 181, Mass. Gen. Hosp. Records,

Within six months pain has been more severe and constant. Under treatment in the out-patient room for some time without benefit, and referred to the house to have the nerve stretched.

August 23d. Under ether the limb was forcibly extended so as to put the nerve on the stretch.

August 24th. Pain somewhat relieved. Patient examined by Dr. Putnam, who advised against operation. Discharged. Slightly benefited.

#### CASES OF NERVE-SECTION FOR NEURALGIA.

CASE IV. October 14, 1887. S. P. B.<sup>6</sup> The case of this patient was reported by me in a paper read before this Society, October 11, 1886, and published in the JOURNAL, October 21, 1886. Has had complete relief for one year. A few weeks ago the pain returned worse than ever. No assignable cause. He was put upon salicylate of soda in twenty-grain doses three times a day. Dr. Putnam also applied rhigolene. There was some benefit from this treatment. The pain recurred every morning about six o'clock with a less severe paroxysm towards night. Quinine taken at 4 A.M. relieved the pain for three or four days, and he was, at his request, discharged to continue the treatment at home.

November 4, 1887. Re-enters for operation, with pain as severe as ever.

<sup>6</sup> Vol. CCXXXIV, p. 13, Mass. Gen. Hosp. Records.

November 7th. Operation. An incision was made over the ascending ramus of the jaw about two inches in length parallel and between the fibres of the masseter. The branches of the facial nerves were carefully avoided. On scraping back the periosteum at the same place where the jaw had been trephined the year before the surface of the bone was found to be perfectly smooth, and without the slightest sign of the previous operation. The chisel was applied along the course of the inferior dental canal, but neither canal nor nerve could be found. The whole region of the canal was gouged out as before. The mental foramen was next found after thrusting a pin into it. The nerve was found emerging from the foramen enormously enlarged. Its branches were collected together, and pulled out of the canal, and also from the tissues to which it was distributed. The foramen was chiselled out and the nerve destroyed a considerable distance. Wounds closed with silk and drained in the usual manner. The next day there was very severe pain. Wound was found sealed, and the tube was removed. Pain continued very severe, and paroxysmal in character.

Ten days after operation the pain began to be less. Wounds healed by first intention. Pain gradually disappeared, and he was discharged the 19th.

This case is interesting from its continued recurrence, and from the evident fact that the pain was due to collateral trunks. The size of the branches

emerging from the mental foramen was very evidently much greater than is ever seen in the normal nerve. Another interesting fact was the entire obliteration of the canal at the seat of the former operation, showing, of course, that there had been no regeneration of the trunk of the nerve in the way usually supposed.

January 6, 1888, I saw the following case in consultation with Dr. Walton. P. S., from Connecticut, foreman of a machine shop. Six weeks ago while working on a lathe the bar of steel on which he was at work flew from the lathe and struck him over the right eye. After recovery from the immediate effects of the injury, he continued to experience peculiar sensations on the right side of his head with more or less dull pain extending from the right supra-orbital region to the top of his head, and sometimes in the occipital region of that side. He found difficulty in draughting on account of sensations in his head which he described as not exactly a pain, but as a confused sensation sometimes accompanied by pricking and numbness. While sitting perfectly quiet there was no special pain anywhere. There is a broad linear scar extending obliquely upwards and forwards from the outer angle of the orbit about three-quarters of an inch in length. Slight loss of substance. Not adherent to the underlying parts. The lightest touch behind this scar outwards over the tem-

poral region caused tingling sensations to run upwards over the entire region supplied by the supra-orbital nerve. Deep pressure over the nerve or its branches caused no sensitiveness or pain. A light touch inside the scar produced no symptoms whatever. There was no tenderness over the supra-orbital notch. The patient complained of a numb sensation in the regions supplied by the supra-orbital nerve, but the physical examination showed no definite loss of sensation. Dr. Walton was of the opinion that the lateral branches of the supra-orbital nerve were involved in the cicatrix and advised excision of the scar.

January 7th, I excised the scar, and found a large branch of the supra-orbital running directly into it. I caught it with strong forceps, and twisted it out of the tissues. Wound closed with silk. January 8th, first intention. Complete cessation of sensitiveness and sensations of discomfort.

#### NERVE SECTION OF SPASMODIC WRY-NECK.

CASE I. October 17, 1887. Mrs. M. A. R.,<sup>7</sup> aged forty-eight. A very nervous and spare woman who for four years had suffered from contraction of the right sterno-mastoid and trapezius muscles. This was not constant at first but very painful. For a long time the spasm was tonic and clonic with more or less constant pain. The head was drawn to

<sup>7</sup> Vol. CCXXX, p. 229, Mass. Gen. Hosp. Records.

the right and rotated slightly. She had been under the care of Dr. Putnam with whom I had seen her in consultation. She had tried many remedies without effect. Electricity and various apparatus had also been used without success. As a last measure division of the right spinal accessory nerve was advised by Dr. Putnam and myself, and she was sent to the hospital for that purpose.

At the time of entrance it was found that the right sterno-mastoid was rigid, and permanently contracted. When fully relaxed the head could be brought to an erect position, but no farther than that. She could hold the head erect herself, but on relaxing her efforts it would be drawn towards the right shoulder and rotated towards the left.

October 28th. Under ether an incision *one inch* long was made over the nerve along the anterior border of the right sterno-mastoid muscle. The dissection was carried directly backwards towards the vertebræ. The nerve was found very easily, and an inch of it removed. The diagnosis was confirmed by the electric current before the nerve was divided. The wound was closed with silk and iodoform gauze applied. Bichloride solution irrigation during the operation.

Two days later the stitches were removed. The right sterno-mastoid was soft and flexible. The head was erect and there was no pain. The head was carried towards the right shoulder at times from force of habit.



A few weeks later she re-entered for the purpose of having the right trapezius divided. It had been found since the operation that the anterior fibres of this muscle were somewhat contracted, and that it was impossible to bring the head to more than the erect position on account of this shortening, and the previous long-continued contraction. After the division of the spinal accessory nerve the trapezius together with the sterno-mastoid had become much relaxed, and had ceased their spasmodic contraction. The sterno-mastoid was easily stretched to allow free movement of the head, but the trapezius would not allow this motion. The other muscles on that side seemed also to be contracted, especially the scalenus medius. After careful examination it was thought impracticable to relieve the contraction by division of the trapezius alone, and a general division of the muscles on that side too severe an operation to be thought of, considering the slight discomfort then present. At the present time she is very comfortable, and will have an apparatus to stretch the affected muscles. An interesting point in this case is the question of collateral nerve supply to the sterno-mastoid. The main supply is from the spinal accessory, but it also has some filaments from the cervical plexus. The immediate effect of division of the spinal accessory is to relax the muscles, to weaken it but not to paralyze it completely. It is a very much more satisfactory



operation than stretching, and I believe it to be even safer. The case of stretching reported last year was not permanently benefited. The fear of causing complete paralysis of the muscle is groundless, and the effect on the muscle is just what is desired. As to the matter of incision, it seems to me that the cut I have described along the anterior border of the sterno-mastoid is much better than any other. The nerve proceeds outwards from the jugular foramen, and enters the muscle obliquely about an inch and a half below the mastoid process. It can be found at the bottom of an incision an inch long made at this point. An aid to finding it is to scratch with a director the tissues at the bottom of the wound as you go along, by which the nerve is irritated into causing a contraction of the muscle. It is also large enough to be felt in a thin person. If the mastoid alone is to be affected it might be better to seek the mastoid portion by an incision through the centre of the muscle parallel to the fibres. The part of the trapezius supplied by this nerve is so small, however, that I think it is just as well to divide the main trunk.

#### NERVE SECTION AND SUTURE.

CASE I. August 25, 1887. Patrick Treeny,<sup>8</sup> aged thirty-two, laborer. For six or seven years has had a tumor near the elbow which has been very tender

<sup>8</sup> Vol. CCXXXII, p. 189, Mass. Gen. Hosp. Records.

to the touch, and the seat of severe pain. Also another on the back near the left scapula. A small bunch is seen just behind and above the internal condyle of right humerus, the size of a cherry. The pain runs down into the hand.

August 26th. Operation. An incision was made along the course of the ulnar nerve just over tumor. A tumor was found encapsulated in the nerve trunk itself, the fibres of which could be seen spreading over and through it. The capsule of nerve and tumor was found to be the same and continuous. As it was impossible to dissect the tumor from the nerve, the nerve itself was cut both above and below. By extending the arm and relaxing the nerve, and by stretching it, the ends were readily approximated and the sheaths stitched with cat-gut, making a very perfect joint. The wound was closed with a continuous cat-gut stitch. Antiseptic dressings. The arm was placed extended upon a splint which reached almost to the axilla. For a few days after the operation there was a good deal of pain in the wound, and numbness in the arm and hand. Paralysis of sensation along the course of the ulnar nerve.

September 5th, the splint was removed from the arm, and the wound found to be solid. The same day the tumor over the scapula was dissected out and found not to be connected with any nerve large enough to be seen. Five days later the stitches were re-

moved. There seemed to be at this time a certain amount of separation of the fingers possible, especially in the abduction of the index finger. Hand still decidedly weaker than the opposite.

September 14th. Discharged to the Out-patient Department. Examined by Dr. Walton, some weeks later. The muscles supplied by the ulnar nerve were atrophied, and showed the re-action of degeneration.

In this case the principal trouble was excessive and disabling pain, especially in the tumor of the arm. This was completely relieved by the operation. The man has been lost sight of, and it is a question how much restoration of the motor function of the nerve has taken place. It may be said, however, that none of the accidents or complications of nerve suture were present in this case, for he was perfectly free from symptoms of neuritis, and from that disturbance of the nervous system sometimes seen after nerve section and suture.

Dr. Putnam's report of the microscopic examination of the tumor: "Tumor attached to the ulnar nerve. Size of a small walnut. The ulnar nerve in passing over it is spread out so as to cover a space one and a half centimetres wide. Examination of the nerve fibres shows some of them to be healthy, others in a state of commencing degeneration. On examination the tumor proves to be a sarcoma. It is made up of a mass of fibres, small cells with elongated pro-

cesses and round cells. Here and there a small mass of fat cells is to be seen. The cells are readily stained with hæmatoxylin and on treatment with acetic acid are seen to contain a distinct nucleus. The intervening fibrous substance is not arranged in any characteristic manner."

CASE II. July 6, 1887. William Cline,<sup>9</sup> brakeman, aged twenty-two. Caught his wrist between the bunters while switching cars. Had a cut over the inner and posterior surface of the wrist just above the styloid process of the ulna. The edges were ragged and the muscles torn and bruised. Ulnar nerve divided as well as the tendon of the flexor carpi ulnaris. Under ether the ends of the nerves were found and sutured with fine cat-gut. The tendon ends were also sewed together with the same. Wound united with silk, and iodoform gauze dressings applied. The arm was laid in a tin splint so as to keep wrist flexed. Internal angular splint.

The next day had severe pain in hand and arm. The pain was along the course of the ulnar nerve, and in the little finger. Temperature was elevated the second day after the operation. Wrist was found to be swollen and very tender. All stitches were removed. A few drops of pus were squeezed out. Dry dressings.

July 9th. Phenyle poultice. Wound suppurating.

<sup>9</sup> Vol. CCXXXII, p. 98, Mass. Gen. Hosp. Records.

July 15th. Wound granulating, and in good condition. Discharged to the Out-patient Department.

I have not been able to see this man since he left the hospital. He has been at his work as freight brakeman on the Fitchburg Railroad ever since, and I understand that he is able to attend to all the duties of that position.

NOTE. — Examination later showed complete restoration of motor function.

#### OPERATIONS TO RELIEVE PAIN FROM PRESSURE.

CASE I. April 13, 1887. J. L.,<sup>10</sup> mill operative, aged twenty-three. Father had sciatic rheumatism. One sister had cerebro-spinal meningitis. Always strong and well. Four years ago turned her left ankle. Five months later began to have constant pain limited to a small area on the outer side of the left leg about the middle of the calf. A sharp lancinating pain extended along the course of the musculo-cutaneous nerve. This spot was also very sensitive to pressure. Pain was increased by exercise. Left leg occasionally swollen. Had been treated with rubber bandage, blistered eleven times, actual cautery two years ago, and electricity. No relief. Had been wearing a rubber stocking for some time. Had a scar on the outer side of the calf at about the junction of middle and upper third of the leg about the size of

<sup>10</sup> Vol. CCXXX, p. 263, Mass. Gen. Hosp. Records.

a vaccination mark, caused by the cautery. This is the seat of the pain and is very tender. Very slight tenderness over a small area about it. Was given salicylate of soda, ten grains three times a day.

April 20th. No relief. Operation by Dr. Beach under ether. The scar left by the cautery dissected out. Dissection carried down to the fascia. No nerve fibres discovered. Closed by silk sutures and antiseptic dressings.

April 22d. Some tenderness over the incision. None of the lancinating pain. Stitches removed.

April 26th. Healed by first intention. No pain, and scarcely any tenderness. Discharged.

July 28th. Re-entered. Was free from pain for about three weeks after discharge. Pain and tenderness returned in former situation and of greater severity than before.

July 30th. Operation. An incision was made in the line of the scar of the former operation extending an inch above and below it. The cicatrix of the former operation was removed by an elliptical cut. Aponeurosis covering the muscles was exposed and nerves carefully sought. No nerve filaments could be found whatever. There was no evidence that the cicatrix had involved any considerable nerve branch. The fascia was then divided by a crucial incision, and the musculo-cutaneous nerve sought in the space between the extensor communis digitorum and the pero-



neus longus. After quite prolonged search among the fibres of these muscles which had a peculiar fatty-infiltrated appearance at this point, a tumor was found into which the nerve apparently went. The tumor was removed without difficulty. It was encapsulated. What appeared to be the nerve was a fibrous band from the intermuscular septum which expended and lost itself in the tumor. The musculo-cutaneous nerve was found in such a position that it was evidently compressed between the fibula and the tumor. The gross appearance of the tumor was that of a melanotic sarcoma. Unfortunately it was lost and no microscopic examination was made.

August 5th. Stitches out. No pain.

August 10. Discharged well. No pain.

November, 1887. She wrote that there was a return of pain or rather discomfort. Was advised to return for examination.

This case illustrates the importance of seeking a cause for a persistent local pain. There was not the slightest evidence of the existence of a tumor by physical examination. Yet there is no doubt that she had been suffering not only from long-continued pain, but from repeated therapeutic measures. I think it may be said as a rule that persistent pain localized in the course of a nerve which has not yielded to a long-continued course of counter-irritation and internal remedies, makes it the duty of the sur-



geon to cut down and see if there is not some cause that can be removed as easily as this was. Moreover, if there is a tumor pressing on the nerve the sooner it is removed the better, especially if it proves to be, what this probably was, malignant. The recurrence of pain in this case leads me to think that there is a return of the growth, and I have advised her to come immediately for examination and operation.

CASE II. Mary A. P.,<sup>11</sup> aged twenty-three. Fourteen years before entrance she fell and injured the right elbow. Then arm was put on a splint and kept there six weeks. Never had any trouble in it till recently though the elbow-joint was a little stiff. Four or five years ago the elbow began to pain her. She first noticed pain in bending the arm to a right angle. That has steadily increased till at the time of the operation the arm was almost entirely disabled, and she wore it in a sling. On examination of the arm a small bony growth was perceived at the elbow-joint, situated just to the outside of the tendon of the biceps. The pain as described followed the course of the external cutaneous nerve. There was very little tenderness in the bunch itself, but at a certain point in flexion and extension there was a sharp twinging pain like that of the crazy bone. A diagnosis of pressure on the external cutaneous nerve was made.

<sup>11</sup> St. Margaret's.

On cutting down to the bony projection the nerve was found between it and the biceps tendon in so close re-

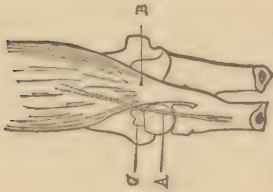


FIGURE III.

A, Exostosis.  
B, Musculo-cutaneous nerve.  
C, Tendon of biceps.

lation that every time the biceps was flexed or extended the nerve was sharply compressed between the two. The growth was chiselled off smooth from the lower part of the humerus, to which it was attached, and the wound closed as

usual. Corrosive sublimate irrigation and iodoform dressings. Healing was by first intention. The pain was relieved entirely and has never returned.





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